PHYSICS

PHYSICS COLLOQUIUM

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Turbulent amplification of cosmic magnetic fields

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As foreseen by Chandrasekhar, advances in the physics of turbulence play an important part in the development of astrophysics. Thanks to the modern numerical techniques and observations, significant progress has been made in understanding the statistics and dynamics of turbulence in the astrophysical context. Among the fruitful applications of turbulence to a wide diversity of astrophysical phenomena, I will focus on the turbulent amplification of cosmic magnetic fields, i.e., the turbulent dynamo. Magnetic fields fill the universe. They play a fundamental role in many astrophysical processes over a vast range of length scales through the evolution of the universe. Turbulence, which is ubiquitous in the universe, is found to be responsible for the amplification and maintenance of cosmic magnetic fields, with the turbulent kinetic energy converted to magnetic energy. I will talk about my work on developing a new dynamo theory that can be generally applied to a variety of plasma conditions, its supercomputer numerical tests in a weakly ionized medium, and its applications to interpreting puzzling astrophysical observations.